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(57) Abstract

A process for the preparation of a texturing agent which comprises heating a mixture of starch, protein and water to at least partially gelatinise the starch and subjecting the mixture to shear and size reduction wherein the ratio of protein to starch solids is from 1:10 to 1:500 by weight and the amount of starch solids is from 1.5 to 25 % by weight based on the total weight of the mixture.

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TEXTURING AGENT

BACKGROUND OF THE INVENTION

The present invention relates to a texturing agent and more particularly to a texturing and fat replacing agent comprising starch, protein and water in certain proportions and a process for its preparation.

Fat substitutes are used in the food industry as replacements for some or all of the fats normally found in food products. Fat substitutes may consist of substances such as starches, gums or proteins which mimic the mouth-feel of fat. We have found that the combination of heat and shear on a mixture of starch, protein and water in certain proportions produces a product which is not only a fat replacer but also a texturing agent, e.g. the product is smooth and may increase the viscosity, consistency and stability of a product in which it is incorporated.

SUMMARY OF THE INVENTION

According to the present invention, there is provided a process for the preparation of a texturing agent which comprises heating a mixture of starch, protein and water to at least partially gelatinise the starch and subjecting the mixture to shear and size reduction wherein the ratio of protein to starch solids is from 1:10 to 1:500 by weight and the amount of starch solids is from 1.5 to 25% by weight based on the total weight of the mixture.

DETAILED DESCRIPTION OF THE INVENTION

The starch used may be derived from any source of starch, for instance, rice, wheat, corn, potato, tapioca, oat or soy. The starch may be in the form of a flour, a slurry or it may even be the entire seed. The protein may be any kind of protein such as a gelating protein, pea protein, soy protein, gelatin or albumin but is preferably a milk protein, e.g. derived from non-fat milk, whole milk, cream, whey protein concentrate or caseinate (including acid casein). If desired, other ingredients such as emulsifiers or sugars may be added to the mixture according to the application.

Although not wishing to be bound by theory, we believe that the combination of shear and heat induces starch gelation and protein denaturation. Analyses of the product, made with different raw materials and processing methods, leads to the conclusion that the functional properties of the texturing agent are the result of the interaction between the proteins (including those naturally present in flours, if used as the starch) and the gelatinized or partially gelatinized starches, which in combination with the final particle size obtained makes the product stable, smooth and suitable as fat replacer and thickening agent. The addition of emulsifier is thought to stabilize the interaction of protein and starch even more. The final product has particles of smaller size compared with the mix before heating and sheared stress. The finer the particle size of the initial mix before heating and sheared stress, the better is the final product. For example, the particle size distribution, measured as volume distribution of the initial mix may be from 20 to 1000 microns and of the final product may be from 0.01 to 400 microns, preferably with one definite peak within the range of 0.1 to 20 microns and another definite peak within the range of from 100 to 400 microns.

In the process of the present invention, the starch, proteins and water are preferably mixed at any temperature below 190°F, heated to a temperature of from 160°F - 280°F and especially from 220°F and 260°F for from 5 seconds to 2 minutes and ideally from 30 seconds to 1 minute. The heating can be accomplished with any heat exchanger currently used for food processing such as a plate heat exchanger, tubular heat exchanger, scraped surface heat exchanger, steam injection, or any combination of them. After heating, the product may be cooled if desired and subjected to shear and size reduction, conveniently at any temperature from 280°F to 120°F, for example, by means of a pump, colloid mill, piston homogenizer or any equipment that can induce shear and reduce size of the particles in the mix of starch and proteins. Afterwards, the product may be cooled to any desirable temperature below 190°F, e.g. 35° to 175°F, using either flush cooling, another heat exchanger device (e.g. plate heat exchanger, tubular heat exchanger, scraped surface heat exchanger) or any combination of plate heat exchangers. The pressure used in a homogeniser may be from 10 to 5000psi and preferably from 100 to 700psi. The cooling time is not critical.

For example, in a first alternative, the mixture of starch, proteins and water may be heated to a temperature from 160° to 280°F, sheared, cooled to a temperature below 190°F and cooled further if necessary. In a second alternative, the mixture of starch, proteins and water may be heated to a temperature from 160° to 280°F, cooled to a temperature from 190° to 120°F, sheared and then further cooled, if necessary.

The selection and final concentration of the starch, protein source, emulsifier type and source, and any other ingredient that needs to be incorporated will depend on the desired final flavor and aroma impact, final texture and stability of the product in application, color, and raw material availability and price. The ratio of protein to starch solids is preferably from 1:20 to 1:80 by weight.

The starch used may be a single flour or starch or it may be a combination of different flours or starches. All the ingredients are mixed before heating. The concentration of starches in the final mixture is preferably from 7 to 18% by weight based on the total weight of the mixture.

The texturing agent may be formed as a solution containing, for example, from 3 to 30% solids by weight. However, it may easily be dried using spray drying, vacuum drying and drum drying. The preferred method is spray drying.

The shelf life may be extended, in the paste form, by the addition of antimicrobial and antifungal agents (sorbates, bensoates, nisin, etc.). The reduction of the pH, e.g. to less than 4.5 by addition of acids such as lactic, malic, citric, acetic acid is another alternative for extending the shelf life.

The incorporation of emulsifiers produces higher viscosity. The emulsifier (s) can be any source of phospholipids, mono and diglycerides, and combinations of the same. It is preferable to use emulsifiers in samples that have to stand long freeze thaw cycles and in frozen foods, such us ice-creams. The concentration of emulsifier in the final mixture can vary between 0 to 1.%, ideally between 0.05 and 0.2% by weight based on the total weight of the mixture expressed as mono and diceglycerides and or phospholipids.

The use of any pump, colloid mill (high shear stress) versus piston homogenization or any method for high shearing and size reduction will depend on the final texture desired for the product in application.

In addition to the texturing and fat replacing benefits of using the texturing agent, it has been observed that its incorporation into sauces helps to the slow the delivery of flavors, which implies that it also can work as a flavor release agent.

The texturing agent may be used in a variety of foodstuffs and the present invention further provides a foodstuff comprising an effective amount of a texturing agent as herein described.

The amount of texturing agent in the foodstuff may be from 0.5 to 98% by weight depending on the requirements.

Typical applications of the texturing agent of the present invention are as follows:

- Thickening and fat replacer agent in sauces.

- Free-thaw stabilizer in sauces.

- Thickening agent and fat replacer in ice-cream .

- Fat replacer and thickening agent in doughs .

- Source of high fiber and stabilizing agent in sauces and beverages, e.g. nutritional beverages.

- Fat replacer and stabilizing agent in mayonnaise type sauce or salad dressing.

- Fat replacer and stabilizing in dairy desserts (flans, puddings).

- Texturing agent and fat reduction in meat balls, meat patties or fish fillet

The comparison of samples with and without texturing agent showed that, with and without emulsifiers in it, the viscosity, consistency, and product stability (measured as the non separation of phases) are significantly increased. The addition of emulsifier increases even more the consistency and stability of the final product, however smoothness is compromised.

EXAMPLES

The following Examples further illustrate the present invention. Parts and percentages are given by weight.

Example 1

A solution containing 11.36% rice flour, 2.46% corn starch, 1.48% wheat flour, 0.71% skim milk powder, 0.1% emulsifier and 83.89% water was mixed at room temperature (final solids content 16% w/w) in an agitated tank. This mix was pumped and heated, using a heat plate exchanger to 160°F, steam injected (90 psi steam) to reach a temperature of 260°F and held at this temperature for 2 min. Then the product was passed through a colloid mill (10,000 rpm) and cooled to 40°F using a tubular heat exchanger. The final solid content was 13% w/w.

Example 2

The same procedure as example 1 was followed but the product was steam injected without preheating.

Example 3

The same procedure as example 1 was followed but the product was directly heated using a plate heat exchanger to 260°F. The final solid content 16% w/w.

Example 4

The same procedure as example 1 was followed but the product was heated using tubular heat exchanger. The final solids content 16% w/w.

Example 5

The same procedure as example 1 was followed but the product was heated to 260°F using a scraped surface heat exchanger.

Example 6

A solution containing 16.14% rice flour, 0.81% skim milk powder, and 83.05% water was mixed. The product was separately heated using steam injection, a tubular heat exchanger, a plate heat exchanger, and a scraped surface heat exchanger to 260°F. Flash evaporation followed steam injection. The holding time at 260°F varied from 30 seconds to 2 min. After heating, the product was separately homogenized, using a colloid mill and a piston homogenizer (up to 550 psi), and then cooled using a tubular heat exchanger to 160°F.

Example 7

The same procedure as example 1 was followed but the mixture contained 0.1% emulsifier in addition to the other ingredients mentioned.

Example 8

Rice flour and skim milk powder were combined in a ratio of 22.5:1, mix and diluted with water to a solid level of 25% w/w. The solution was heated to 250°F, using a tubular heat exchanger, held at this temperature for 30 sec, then homogenized separately using a piston homogenizer (500 psi) and a colloid mill (10,000 rpm), and cooled down to 150°F using a tubular heat exchanger.

Example 9

Rice flour, 38% fat cream, and water were mixed in a ratio 1:1:7, heated to 250°F using tubular heat exchanger, size reduced separately using piston homogenization and colloid mill, and cooled to 100°F using a tubular heat exchanger.

Example 10

The same procedure as example 9 was followed but instead using a mix of wheat flour, corn starch and rice flour in a ratio 1:1:5.

Example 11

The same procedure as example 9 was followed but adding, in addition, 0.12% by weight of emulsifier based on the weight of the final mixture.

Example 12

Rice flour, whole milk powder, and water were mixed in a ratio 8:1:52, heated to 250°F using tubular heat exchanger, size reduced separately using piston homogenization and colloid mill, and cooled to 100°F using a tubular heat exchanger.

Example 13

The same procedure as example 12 was followed but using a mix of wheat flour, corn starch and rice flour in a ratio of 1:1:5.

Example 14

The same procedure as example 12 was followed but adding, in addition, 0.12% by weight of emulsifier based on the weight of the final mixture.

Example 15

The same procedure as example 13 was followed but adding, in addition, 0.12% by weight of emulsifier based on the weight of the final mixture.

Example 16

A solution containing 16.14% rice flour, 0.3% of Na-Caseinate as powder, and 83.56% water was mixed. Four samples of the product were separately heated using steam injection, tubular heat exchanger, plate heat exchanger, and scraped surface heat exchanger to 260°F. Flash evaporation followed steam injection. Holding time at 260°F varied between 30 sec. to 2 min. After heating, the products were separately homogenized, using colloid mill and piston homogenizer (up to 550 psi), and then cooled using a tubular heat exchanger to 160°F.

Example 17

The same procedure as example 16 was followed but adding, in addition, 0.15% by weight of emulsifier based on the weight of the final mixture.

Example 18

A solution containing 16.14% rice flour, 0.8% whey protein concentrate (65% protein), and 83.06% water was mixed. Four samples of the product were separately heated using steam injection, tubular heat exchanger, plate heat exchanger, and scraped surface heat exchanger to 260°F. Flash evaporation followed steam injection. The holding time at 260°F varied between 30 sec. to 2 min. After heating the products were separately homogenized, using colloid mill and piston homogenizer (up to 550psi), and then cooled using tubular heat exchanger to 160°F.

Example 19

The same procedure as example 18 was followed but adding, in addition 0.1% by weight of emulsifier based on the weight of the final mixture.

Example 20

A solution containing 16.14% rice flour, 0.6% of acid casein, and 83.26% water was mixed. Four sample of the product were separately heated using steam injection, tubular heat exchanger, plate heat exchanger, and scraped surface heat exchanger to 260°F. Flash evaporation followed steam injection. Holding time at 260°F varied between 30 sec. to 2 min. After heating, the products were separately homogenized using colloid mill and piston homogenizer (up to 550 psi), and then cooled using tubular heat exchanger to 160°F.

Example 21

The same procedure as example 20 was followed but adding, in addition 0.1% by weight of emulsifier based on the weight of the final mixture.

Example 22

Replacement of cheese sauce and fat reduction.

Cheese sauces were mixed with texturing agents of different solid levels content, with and without emulsifier and separately homogenized using piston homogenization and colloid mill. The replacement of sauce with texturing agent was between 5 to 50% w/w. After production the samples containing the texturing agent were subjected to freeze thaw stability tests.

From the sensory and rheological evaluation it was concluded that replacement of the base sauce with from 10 to 25%, the use of colloid mill for homogenization, and use of a texturing agent with 13.5% Ts gave the best final product. Flavor, color, and texture in frozen low fat sauces were improved with addition of texturing agent. Texture agents with and without emulsifier were tested in low fat sauces and were both preferred to control without texture agent, however, there was a slight preference for sauce made without emulsifier.

Example 23

Improved ß-glucan content in sauces for lower rate of digestion.

Texturing agent samples containing 0.7% non-fat milk powder together with rice flour and oat flour in ratios 1:1, 1:2, and 1:3 were mixed with water to a final concentration of 15% Ts. The mix was heated using a tubular heat exchanger, size reduced using colloid mill and homogenization and cooled to 100°F using a tubular heat exchanger.

From the evaluation of the samples it was concluded that the processing conditions for the best sample, in terms of texture and flavor, were ratio rice to oat flour of 1:2, size reduction, piston homogenizer (500 psi), and heating at 240-260°F.

Example 24

Fat reduction and stabilization of salad dressing.

Texturing agents prepared as in examples 1, 2, 6, 7, 9, 11, 12, 14 and 15 were mixed with olive oil, vinegar, salt, sugar and spices and homogenized using high shear mixing.

Example 25

Fat reduction in Sharp Cheese sauce.

Samples of a sharp cheddar cheese sauce produced by Nestlé Food. Co. were mixed with texturing agents as prepared in Examples 6 and 7 in ratios of 1:9, :1:4, and 1:2. From the results it was concluded that the texturing agent produced without emulsifier, using high shear as size reduction method, and mixed in a ratio 1:9 with sharp cheese sauce produced the best sample.

Example 26

Fat reduction and stabilization of Alfredo Sauce.

Samples of 20% of Alfredo sauce (30% fat) were replaced with texturing agents produced as in Examples 1, 2, 6, and 7 respectively. Products made according to examples 6 and 7, where the texturing agent was homogenized using piston homogenizer, gave the best product as compared with the control sample.

Example 27

A solution containing 13.5% rice flour, 0.8% non-fat dried milk and 86.7% water was mixed at room temperature, heat treated using steam injection, heat exchanger or an open kettle at 85°C for 30 seconds, cooled to 60°C and sheared using a piston homogeniser. The product was used for fat reduction in ice cream and frozen foods.

Example 28

The same procedure as in Example 27 was followed but using whey protein instead of non-fat dried milk. The product was used for fat reduction in ice cream and frozen foods.

CLAIMS

1. A process for the preparation of a texturing agent which comprises heating a mixture of starch, protein and water to at least partially gelatinise the starch and subjecting the mixture to shear and size reduction wherein the ratio of protein to starch solids is from 1:10 to 1:500 by weight and the amount of starch solids is from 1.5 to 25% by weight based on the total weight of the mixture.

2. A process acording to claim 1 wherein the starch flour used is derived from rice, wheat, corn, potato, tapioca, oat or soy.

3. A process acording to claim 1 wherein the protein is a gelating protein, pea protein, soy protein, gelatin, albumin or a milk protein.

4. A process acording to claim 3 wherein the milk protein is derived from non-fat milk, whole milk, cream, whey protein concentrate or caseinate (including acid casein).

5. A process acording to claim 1 wherein emulsifiers or sugars are added to the mixture.

6. A process acording to claim 1 wherein the starch flour, proteins and water are mixed at any temperature below 190°F, then heated to a temperature of from 160°F - 280°F for from 5 seconds to 2 minutes.

7. A process acording to claim 1 wherein the heating is accomplished with a plate heat exchanger, tubular heat exchanger, scraped surface heat exchanger, steam injection, or any combination of them.

8. A process acording to claim 1 wherein after heating, the product is subjected to shear and size reduction at any temperature from 280°F to 120°F, by means of a pump, colloid mill or piston homogenizer or any equipment that can induce shear and reduce size of the particles in the mix of starch and proteins and cooled to any desirable temperature below 190°F using any combination of heat exchanger devices or flush cooling.

9. A process acording to claim 1 wherein the pressure used in the homogeniser is from 10 to 5000psi

10. A process according to claim 1 wherein the texturing agent is formed as a solution containing from 3 to 30% solids by weight.

11. A process according to claim 1 wherein the texturing agent formed as a solution is subsequently dried using spray drying, vacuum drying and drum drying.

12. A process according to claim 5 wherein the emulsifier is any source of phospholipids, mono and diglycerides, and combinations of the same.

13. A process according to claim 1 wherein the concentration of emulsifier in the final mixture is from 0.01 to 1.% by weight based on the total weight of the mixture expressed as mono and diceglycerides and or phospholipids.

14. A process acording to claim 1 wherein the the particle size distribution, measured as volume distribution of the final product ranges from 0.01 to 400 microns.

15. A process according to claim 14 wherein there is one definite peak within the range of 0.1 to 20 microns and another definite peak within the range of from 100 to 400 microns

16. A texturing agent obtainable by a process according to any of the preceding claims.

17. A foodstuff comprising an effective amount of a texturing agent whenever prepared by a process according to any one of the perceding claims.

18. A foodstuff according to claim 17 wherein the amount of texturing agent in the foodstuff is from 0.5 to 98% by weight.

19. A foodstuff according to claim 17 which is a sauce, ice-cream, dough, beverage, nutritional beverage, mayonnaise type sauce, meat patty, salad dressing, dairy dessert (flans, puddings), meat ball or fish fillet.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 112 504 A (CPC INTERNATIONAL) 4 July 1984 see claims; examples ---	1-19
A	WO 94 23588 A (GRIFFITH LABORATORIES) 27 October 1994 see claims 1,3,4,7-10,12,13 ---	1-19
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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